A sunspot may be considered as a rupture of the photosphere.

The radiations of a sunspot are different from the average radiation of the photosphere.

The correlation between the frequency variation of sunspots and the magnetic phenomena is a well-established fact.

Therefore, one may suspect in sunspots some *particular kind of radiation*, capable of producing our terrestrial magnetic disturbances and polar auroras.

Now the question is: Can simple statistics settle the question of the nature of this radiation?

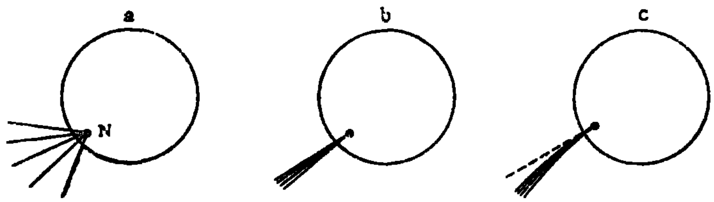

FIG. 1.—Sketch illustrating three different manners in which possible solar radiations might be sent out into space from a sunspot *N*.

Suppose a sunspot *N* (fig. 1). For the radiation producing the magnetic storm one may presume the three cases *a*, *b*, and *c*, sketched in.

Considering, for the days of magnetic storms, the distribution of sunspots separately east and west of the central meridian, and making the tabulations according to the distances from the center of the solar disk, we will have to find:

In case *a*, no particular maxima except such maxima as may be due to the effect of perspective.

In case *b*, a maximum of most central positions. In case *c*, 2 maxima, one east, and the other west of the central meridian, for positions of about 45° from the center of the disk.

I made the calculations for the dates of magnetic storms observed in Porto Rico during the years 1903 to 1908; for those observed at Bombay from 1874 to 1892; and also for those observed at Greenwich from 1882 to 1903; and from the numerical results thus obtained I conclude that the hypothesis of Terby, as well as that of Veeder, may be discarded and that Arrhenius' theory does not explain the facts.

I will simply give the figures for the days of beginning of the 60 most active storms observed at Greenwich. Expressed in per cent of the total areas occupied by sunspots these figures are for each tenth of the solar radius:

Solar longitude.	Tenth of the sun's radius.									
	1	2	3	4	5	6	7	8	9	10
	%	%	%	%	%	%	%	%	%	%
0°–180°	4.96	2.68	4.93	1.24	2.69	11.05	2.15	3.44	1.06	0.08
181°–360°	0.01	1.31	3.52	6.50	12.85	7.91	12.00	8.34	5.58	4.60

The prevailing positions of spots for the days of magnetic storms, are therefore such that we have to admit that the radiations producing the storms are restricted pencils of rays, deviated from the normal and propagated from the sun to the earth with a velocity similar to the velocity of light.

If this radiation consists of β rays, as has already been supposed by A. Brester and others, the deviation in particular cases will, perhaps, give some information on the fluctuations of the intensity of the magnetic field in sunspots.

In order to verify the assumption that we have really to deal with β rays I made some more calculations.[2]

One of the most characteristic properties of β rays being to produce the condensation of vapors, if the magnetic storms are due to β rays, we may evidently expect a correlation between rainfall and magnetic storms. The observations made in Batavia from 1886 to 1899 give, for the days of magnetic storms (190 in all) and for the days preceding and following these days, perfectly convincing figures.

The totals expressed in millimeters are:

−6	−5	−4	−3	−2	−1	0
933	*1195*	1075	735	1117	1120	*1450*
+1	+2	+3	+4	+5	+6	+7
933	913	838	*1034*	928	837	873

The secondary maxima observed 5 days before the date of the magnetic storms and 4 days afterwards may be considered as a confirmation of Loomis' observations.

The Greenwich data of 1882 to 1903 give a similar result for the secondary maxima, but for the days of magnetic storms rainfall in Greenwich is at its minimum.

But we may notice that Montigny observed in Brussels that the twinkling of the stars is more pronounced on the days of magnetic storms than before and after those days. This shows evidently that condensation would take place at Brussels or at Greenwich, just as at Batavia, if the atmospheric conditions were favorable.

This leads to the question whether magnetic storms may occur only under anticyclonic conditions prevailing in high latitudes? Or, taking into account the researches of Störmer and Birkeland, then only when the atmospheric conditions are favorable for the penetration of β rays to lower altitudes.

The consequence is that the rainfall data not only verify the β rays hypothesis but that other correlations with different orders of meteorological phenomena may also be expected.[3]

551.55 (794)

LOCAL WIND OF THE FOEHN TYPE NEAR SAN FRANCISCO BAY.

By BURTON M. VARNEY, Instructor in Geography.

[University of California, Berkeley, Cal., Nov. 15, 1917.]

Dynamic warming of air by descent from mountains into valleys or onto plains is a well-recognized meteorological phenomenon. It occurs notably in the Swiss valleys on the north side of the Alps, under the control of areas of low barometric pressure moving across central Europe. The [dry] chinook winds over the high plains of the western United States and Canada are of similar origin. A wind of the foehn type, produced in a somewhat similar fashion, though controlled rather by high pressures than by low, is occasionally felt at Berkeley, Cal., where the University of California maintains a meteorological station. This wind, blowing from the east or northeast, causes, if it lasts for more than a few hours, very dry atmospheric conditions at Berkeley, and in the summer time uncomfortably high temperatures. This is in strong contrast to the cool, rather moist westerly wind

[2] The reader's attention is here asked to Störmer's memoir in Journal of Terrestrial Magnetism for September, 1917, wherein Störmer shows that, as far as the production of the aurora is concerned, it is difficult to harmonize the facts with the hypothesis that the aurora is due to negatively charged particles (β rays).

A brief note on Brester's theory of the sun was published in the MONTHLY WEATHER REVIEW for October, 1917, p. 485.

Relations between sunspots and rainfall have been discussed in this REVIEW for February, 1907 (35:72), and July, 1907 (35:309).—C. A., jr.

conditions which hold for much of the year under the control of a local indraft of surface air through the Golden Gate and across San Francisco Bay.

The campus of the University of California lies at the foot of the Berkeley Hills, which overlook the bay. The instrumental exposures at the meteorological station range from 300 to 325 feet above sealevel. On the east rise the hills to altitudes of 1,500 to 1,900 feet within a mile and a half to 2 miles, and on the west a smoothly sloping plain falls away to the bay some two miles distant. The topography favors dynamic warming of air which crosses the hills from an easterly direction and is forced to descend the slopes toward the bay. Easterly winds are not common at Berkeley. For their occurrence, a dominant area of high barometric pressure over the Cordilleran region with gradients sloping westward and southwestward toward the Pacific, is necessary. Under these conditions, rarely in summer and occasionally in winter, the persistent westerly and southwesterly wind at Berkeley is fully reversed and an offshore wind produced. The length of time during which this reversal may hold is variable in the extreme, and depends on a delicate adjustment of atmospheric conditions the details of which are, as yet, too obscure for discussion.

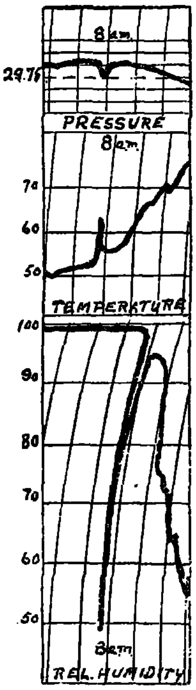

FIG. 1.—Copy of barogram, thermogram, and hygrogram recorded at University of California, Nov. 2, 1917, showing abrupt changes due to temporary prevalence of an easterly wind at Berkeley.

This easterly surface current, occurring at Berkeley more frequently in winter, apparently differs in its origin from an upper current occurring in the San Francisco Bay region in summer, and noted by McAdie as follows:[1]

> Kite experiments indicate that at the 1,000-meter (3,280-foot) level on summer afternoons there is a moderately strong flow of air from east to west. It would seem as if the heated air of the Great Valley, or some portion of it, moved seaward above the level of the incoming or eastward flow of the surface draught.

The surface current occurs chiefly when the continent has prevailingly high pressures as contrasted with the low pressures of the oceanic area, while the upper current occurs when the continent is prevailingly under low pressure and the oceanic area high pressure.

A striking example of a very short lived easterly wind occurred in the early forenoon of November 2, 1917. Atmospheric pressures over Nevada and Arizona on that morning were high (30.00 inches in central Nevada), and the winds over the California coast were mainly offshore and moderate. At San Francisco, however, the 5 a. m. [8 a. m. 75th meridian time] observation at the local office of the Weather Bureau indicated moderate westerly winds. At Berkeley up to about 7:30 a. m. the winds were also westerly and moderate. Between 7:30 a. m. and 8:00 a. m. the prevailing easterly wind dominating the Pacific slope overcame the westerly wind at Berkeley. The abrupt change in the atmospheric conditions is shown in the accompanying traces of the autographic records made at the meteorological station. (See fig. 1.) As a result of warmth of the descending air, in part dynamically produced, the temperature rose 12 degrees in less than that number of minutes. The pressure dropped nearly 0.10 inch when the relatively warm and therefore lighter air from the hills took the place of the cooler, heavier air from the ocean. The relative humidity dropped from very near the saturation point to less than 50 per cent so suddenly that the time occupied can not be judged from the trace. The easterly wind blew for something less than half an hour, and the recovery of all the curves was very rapid. The rapid diurnal rise of temperature and the fall of relative humidity, characteristic of fine weather at this station, would have begun at about the time when conditions were suddenly interrupted by the wind from the hills. There is evidence that this is the case, in the fact that both temperature and humidity curves returned, not to the values they represented before the interruption, but to values approximating those which would have obtained in the uninterrupted diurnal curve.

[1] *McAdie, A. G.:* The rainfall of California. Univ. Cal., Publ. geog., Feb. 19, 1914, 1: 145.

551.578.7 (782)

NEBRASKA HAILSTORM OF AUGUST 8, 1917.

By GEORGE A. LOVELAND, Meteorologist.

[Dated: Weather Bureau Office, Lincoln, Nebr., Nov. 20, 1917.]

During the spring and early summer local storms of greater or less severity may reasonably be expected in that portion of the United States lying east of the Rocky Mountains. Such storms consist of wind, rain, and sometimes hail.

Hail is a very interesting phenomenon in connection with these storms, though occasionally terrifying and destructive. From a study of the rather incomplete hail records of the Nebraska Section Center of the Weather Bureau, it is found that out of a possible 100 per cent hail probability during the four months, May, June, July, and August, 33 per cent of the hail would occur in June, 23 per cent in May and July each, and 21 per cent in August.

What is doubtless one of the most remarkable hailstorms on record is that which occurred in southeastern Nebraska on August 8, 1917—remarkable in the unusual length and breadth of the area covered, the great amount of damage done to crops and property, the large size of the individual hailstones, and the enormous quantity of hail that fell.

From reports of cooperative observers, conversations with citizens in the hail district, newspaper accounts of the storm, and from a personal visit by the writer three days later to a portion of the devastated district, the course and duration of the storm has been quite accurately defined (see fig. 1), it has been possible to make a somewhat correct estimate of the damage done, and many interesting and unusual facts have been brought out.

The storm traveled from a point in Merrick County north of Central City to the Kansas line south of Wymore, in Gage County, a distance of approximately 92 miles in length, and over a width of 4, 8, or even 12 miles, as variously reported. In hailstorms recorded in the past the length is usually less than 50 miles and the width but 1 or 2 miles.

The writer has been unable to obtain any actual measurements of the hailstones in this storm, but the common description was "as large as hen's eggs," or "as big as your fist," or, most common of all, "the size of baseballs." In one house in York the hail blew in through a wire screen, a glass windowpane, and a thick cloth shade which happened to be down, and an hour later the owner of the house found a hailstone on the bed, and according to her testimony it was then the